## REMARKS/ARGUMENTS

Claims 1-17, 19-27, 29-31, 33-40 and 42-45 are pending in the application. The Examiner has rejected claims 1-9, 12-17 and 43 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,720,519 (Lui *et al.*). The Examiner has rejected claims 10-11, 19-27, 29-31, 33-40, 42 and 44-45 under 35 U.S.C. §103(a) as being unpatentable over Lui *et al.* ('519) and further in view of U.S. Patent No. 6,621,045 (Lui *et al.*) and U.S. Patent Application Publication No. US 2002/0170891 A1 (Boyle *et al.*).

In response to the rejection of claims 1-9, 12-17, and 43 under 35 U.S.C. §102(b), the Applicants respectfully traverse the Examiner's rejection.

As stated in MPEP §2131, "A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros. v. Union Oil Co. Of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). "The identical invention must be shown in as complete detail as is contained in the...claim." *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Lui does not teach each and every element of claim 1. Lui teaches away from the present invention. Lui does not teach a means for providing corrective diagnostic feedback during a drilling operation.

Lui discloses an image transfer lens used to assist in performing image alignment since Lui uses a diffractive optical element (DOE) to split one laser beam into a plurality of sub-beams.

"Alignment is performed by imaging the whole beam pattern through microfilter 1145. Microfilter 1145 is partially transmissive at the individual microfilter apertures. The remainder of microfilter 1145 is opaque (for example, it can be

coated with high-reflectivity dielectric thin films or alternatively, metal films). Therefore, when microfilter 1145 is not aligned correctly, no sub-beams 1137 or only partial sub-beams 1137 can be seen through microfilter 1145 by image transfer lens 1150. In one example, image transfer lens 1150 is a large area CCD camera. The operator of laser system 1100 then moves microfilter 1145 in all three linear dimensions, X-Y-Z, as well as rotation, until all sub-beams 1137 appear on image transfer lens 150. Microfilter 1145 is aligned correctly only when all the sub-beams 1137 are incident upon image transfer lens 1150." (col. 12, lines 30-40)

The Examiner posits that the large area CCD camera used in Lui is what is claimed in claim 1.

Lui does not teach an embodiment where the CCD camera is permanent and is used to provide feedback for alignment while drilling. In Lui, alignment of his microfilter 1145 can only be performed by the operator of the laser system 1100 either prior to, or after a drilling operation. Lui teaches placing a large area CCD camera directly in the light path (see FIG. 3) to perform sub-beam alignment.

The present invention teaches adjustment during a drilling operation using means for providing a diagnostic feedback to said computer means on at least one of said laser pulses, said means being selected from the group consisting of a CCD camera, a photo-diode, an autocorrelator, a power meter, and a quad cell detector. The feedback provided by any one of the components is information pertaining to the laser beam's 15 temporal characteristics, alignment, and power output. (¶17, lines 31-37)

Lui teaches a manual beam alignment that is entirely different than what the present invention claims in independent claim 1.

In summary, Lui does not show all of the elements found in independent claim 1. The Applicants respectfully submit that the elements clearly defined in claim 1 are not shown by the Lui reference and that Lui therefore cannot anticipate the present invention. The Examiner is overlooking the claim limitations that clearly distinguish the present invention from Lui.

With respect to the rejection of claims 10-11, 19-27, 29-31, 33-40, 42 and 44-45 under 35 U.S.C. §103(a) as being unpatentable over Lui ('519) and further in view of Lui ('045) and Boyle, the Applicants respectfully disagree.

As stated in MPEP §2143, "To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine the reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, not in applicant's disclosure." *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991).

Lui ('045) discloses a system and method of using a prior art vacuum work piece holder in conjunction with a directed gas flow.

"Gas delivery system 200 solves the problems left unresolved in the prior art and keeps the surface area of flimsy work piece 130 in focal plane 135 of sub-beams 145 of a laser drilling system by creating a reduced atmospheric pressure in front of the pattern target area of work piece 130 that counteracts the recoil pressure upon work piece 130." (col. 5, lines 28-33)

The import of Lui ('045) is a balancing act between the normal atmospheric pressure present under a flimsy work piece to be drilled, a deflection of the flimsy work piece in the direction of laser beam travel caused by the laser beams impinging on the work piece, and a negative pressure above the flimsy work piece surface where the laser beams impinge by using the gas flow. The gas used may be air or nitrogen. The flow of air across the top surface of the flimsy work piece apparently creates a low pressure area that negates the effects of the impinging laser beams and maintains a constant laser focal plane. No diagnostic feedback control system is disclosed as to measure the deflection of the flimsy work piece to determine how much air flow is required to counteract the force of the laser beams.

The present invention does not require or use the system disclosed in Lui ('045). The present invention teaches the use of an air-tight chamber amply sized to accommodate a large work piece, such as the turbine engine component claimed in claims 31, 33-40, 42 and 44-45. The chamber is maintained at a near vacuum if the work piece is to be drilled in air, or purged using helium. The purpose of the part chamber and its internal environment as used in the present invention is not to compensate for deflections in flimsy work pieces that affect laser focus.

As MPEP §2143.01 states, "Obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teachings, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. *In re Fine*, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 21 USPQ2d 1941 (Fed. Cir. 1992).

The present invention does not use the system of Lui ('045), modified or unmodified.

Boyle teaches a system of laser machining vias (a through-connection in a multi-layer printed circuit board (PCB) or integrated circuit (IC)) using a single pulsed laser beam and a "cleanroom chamber." The chamber is used to develop insulating, oxide linings for the vias.

The chamber is used to:

[0171] Laser machining of via structures in an inert gas environment such as helium and argon permits suppression of oxide growth on the internal via side-walls for applications requiring non-insulating side-walls. The introduction of nitrogen into the gas reaction chamber during machining permits growth of the insulating material silicon nitride on the internal via side-walls for applications requiring non-insulating side walls.

[0172] Following laser machining, a layer is formed on the internal side-wall of the via structure. This layer is formed when substrate material, melted during laser machining, re-solidifies upon cooling. Through suitable choice of gas mixes, their flow rates and their relative concentrations the stoichiometry, microstructure and other properties of this layer can be altered so as to produce a side-wall with electrical and/or optical properties best suited to the desired application. Gas mixes include: Active (e.g. $O_2$, $CO_2$)+Inert gases (e.g. He, Ar) for control of oxide growth in the via internal side-walls, Nitrogen+Inert gases (e.g. He, Ar) for control of nitride growth in the via internal side-walls, Active (e.g. $O_2$, $CO_2$) or Nitrogen+Etchant gas (e.g. chlorofluorocarbons, halocarbons) for control of oxide or nitride growth in the via internal side-walls with reduced surface roughness and reduced debris inside and outside the via structure.

The present invention requires no such attention to chemical reactions. The Examiner argues that Lui ('045) teaches the use of a gas flow to create a reduced pressure in front of the target area of the work piece and Boyle teaches pulsed laser machining of a substrate inside an environmentally controlled chamber. Boyle's use of his cleanroom is for an entirely different purpose.

As stated in MPEP §2143.01, "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *In re Mills*, 16 USPQ2d 1430 (Fed. Cir. 1990).

As stated earlier, nowhere within the Lui ('519) reference is suggested or mentioned feedback provided from a sensor to maintain laser beam alignment. Lui ('045) does not suggest a large chamber for holding a large work piece to be drilled in a complete, or near vacuum. Boyle does not suggest in his clean room chamber an alternative use for large work pieces and that a near vacuum or helium atmosphere is preferred when drilling metals or ceramics as in the present invention. It would not have been obvious to use the teachings of Lui ('519 and '045) and Boyle to arrive at the present invention considering that Lui and Boyle do not suggest the functions that the present invention performs.

As stated under MPEP §2143.01, "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." *In re Gordon*, 221 USPQ 1125 (Fed. Cir. 1984). "If the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not

sufficient to render the claims *prima facie* obvious." *In re Ratti*, 123 USPQ 349(CCPA 1959)

The Examiner states that "it would have been obvious to one having ordinary skill in the art at the time of the invention to use an environmentally controlled chamber during drilling as taught by Boyle *et al.* in the Lui *et al.* ('519) system because this ensures quality control of the product, that is, contamination effects are negated. It is not clear how the Examiner combines and modifies the teachings of Boyle.

The combination of Lui ('519), Lui('045) and Boyle produces an untenable argument that the present invention is obvious. To modify the references in order to suggest the present invention would drastically change the principle of operation of all the references. Therefore, none of the references teach, either alone or in combination, a laser drilling apparatus that uses diagnostic feedback to adjust the laser beam's time, alignment, and power output, and has a chamber large enough for a turbine component. Claims 2-17, 20-27, 29-31, and 34-40 and 42-45 are allowable for the same reasons as their parent claims as well as on their own accord.

A Notice of Appeal is appended hereto in the event the Examiner maintains her rejection.

A petition for a one month extension of time is enclosed along with a check in the amount of $620.00 to cover the cost of the extension of time and Notice of Appeal. Should the Director determine that an additional fee is due, she is hereby authorized to charge said fee to Deposit Account No. 21-0279.

If the Examiner believes that a further telephonic interview will facilitate allowance of the claims, he is respectfully requested to contact the undersigned at 203-777-2268. It is respectfully asserted that the pending

claims are in condition for allowance. Reconsideration and allowance of the pending claims are respectfully requested.

Respectfully submitted,

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I, Antoinette Sullo, hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: "Mail Stop AF, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313" on May 22, 2006.

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